







1 Start-up document

This document is a simple start-up guide describing basic functionality of the drive BFI-E2. Detailed explanations are to be read in User Manual BFI-E2. This manual is attached with the drive itself but also possible to download from www.beijer.se/no/dk/fi.

2 Important Safety Information

Please read the IMPORTANT SAFETY INFORMATION below, and all Warning and Caution information elsewhere.

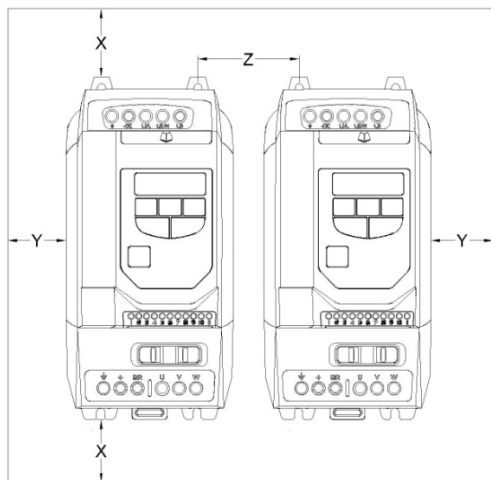
	Danger : Indicates a risk of electric shock, which, if not avoided, could result in damage to the equipment and possible injury or death.		Danger : Indicates a potentially hazardous situation other than electrical, which if not avoided, could result in damage to property.
	<p>This variable speed drive product is intended for professional incorporation into complete equipment or systems as part of a fixed installation. If installed incorrectly it may present a safety hazard. The BFI uses high voltages and currents, carries a high level of stored electrical energy, and is used to control mechanical plant that may cause injury. Close attention is required to system design and electrical installation to avoid hazards in either normal operation or in the event of equipment malfunction. Only qualified electricians are allowed to install and maintain this product.</p> <p>System design, installation, commissioning and maintenance must be carried out only by personnel who have the necessary training and experience. They must carefully read this safety information and the instructions in this Guide and follow all information regarding transport, storage, installation and use of the BFI, including the specified environmental limitations.</p> <p>Do not perform any flash test or voltage withstand test on the BFI. Any electrical measurements required should be carried out with the BFI disconnected.</p> <p>Electric shock hazard! Disconnect and ISOLATE the BFI before attempting any work on it. High voltages are present at the terminals and within the drive for up to 10 minutes after disconnection of the electrical supply. Always ensure by using a suitable multimeter that no voltage is present on any drive power terminals prior to commencing any work.</p> <p>Where supply to the drive is through a plug and socket connector, do not disconnect until 10 minutes have elapsed after turning off the supply.</p> <p>Ensure correct earthing connections. The earth cable must be sufficient to carry the maximum supply fault current which normally will be limited by the fuses or MCB. Suitably rated fuses or MCB should be fitted in the mains supply to the drive, according to any local legislation or codes.</p> <p>Do not carry out any work on the drive control cables whilst power is applied to the drive or to the external control circuits.</p>		
	<p>Within the European Union, all machinery in which this product is used must comply with Directive 98/37/EC, Safety of Machinery. In particular, the machine manufacturer is responsible for providing a main switch and ensuring the electrical equipment complies with EN60204-1.</p> <p>The level of integrity offered by the BFI control input functions – for example stop/start, forward/reverse and maximum speed is not sufficient for use in safety-critical applications without independent channels of protection. All applications where malfunction could cause injury or loss of life must be subject to a risk assessment and further protection provided where needed.</p> <p>The driven motor can start at power up if the enable input signal is present.</p> <p>The STOP function does not remove potentially lethal high voltages. ISOLATE the drive and wait 10 minutes before starting any work on it. Never carry out any work on the Drive, Motor or Motor cable whilst the input power is still applied.</p> <p>The BFI can be programmed to operate the driven motor at speeds above or below the speed achieved when connecting the motor directly to the mains supply. Obtain confirmation from the manufacturers of the motor and the driven machine about suitability for operation over the intended speed range prior to machine start up.</p> <p>Do not activate the automatic fault reset function on any systems whereby this may cause a potentially dangerous situation.</p> <p>The BFI has an Ingress Protection rating of IP20 or IP66 depending on the model. IP20 units must be installed in a suitable enclosure.</p> <p>When mounting the drive, ensure that sufficient cooling is provided. Do not carry out drilling operations with the drive in place, dust and swarf from drilling may lead to damage. BFI are intended for indoor use only.</p> <p>The entry of conductive or flammable foreign bodies should be prevented. Flammable material should not be placed close to the drive</p> <p>Relative humidity must be less than 95% (non-condensing).</p> <p>Ensure that the supply voltage, frequency and no. of phases (1 or 3 phase) correspond to the rating of the BFI as delivered.</p> <p>Never connect the mains power supply to the Output terminals U, V, W.</p> <p>Do not install any type of automatic switchgear between the drive and the motor</p> <p>Wherever control cabling is close to power cabling, maintain a minimum separation of 100 mm and arrange crossings at 90 degrees</p> <p>Ensure that all terminals are tightened to the appropriate torque setting</p> <p>Do not attempt to carry out any repair of the BFI. In the case of suspected fault or malfunction, contact your local Beijer Electronics office for further assistance.</p>		

3 Contents

1	START-UP DOCUMENT	1
2	IMPORTANT SAFETY INFORMATION.....	1
3	CONTENTS.....	2
4	INSTALLATION.....	3
4.1	PHYSICAL DIMENSIONS IP20	3
4.2	PHYSICAL DIMENSIONS IP66	4
4.3	FUSES, CABLE DIMENSIONS AND POWER LOSSES	5
4.4	OVERVIEW POWER INPUT/OUTPUTS	5
4.5	EXTERNAL BRAKE RESISTOR	7
4.6	OVERVIEW CONTROL INPUTS/OUTPUTS	7
5	BASIC PARAMETER SETTING	8
5.1	DIGITAL START SIGNAL IN 2 DIRECTIONS AND 4 FIXED PRESET SPEEDS	8
5.2	DIGITAL START IN 2 DIRECTIONS AND ANALOG FREQUENCY SET POINT	9
5.3	DIGITAL MOTOR POTENTIOMETER	9
5.4	ANALOG OUTPUT, 0-10 VDC	10
5.5	DIGITAL OUTPUTS	10
5.6	CONTROL OF MECHANICAL BRAKE IN MOTOR.....	10
5.7	PTC-THERMISTOR	10
5.8	MODBUS RTU AND CONTROL FROM MITSUBISHI PLC	11
5.9	PI-CONTROL	12
5.10	ENERGY OPTIMISATION FUNCTION.....	12
5.11	SPIN START	13
5.12	OPTISTICK	13
6	KEYPAD.....	14
6.1	CHANGING PARAMETERS.....	14
6.2	RUN MOTOR FROM KEYPAD	14
6.3	FACTORYSETTING OF DRIVE.....	15
6.4	MONITORING FROM KEYPAD.....	15
6.5	IP66, MAINSWITCH, START/STOP SWITCH AND POTENTIOMETER	16
7	SPECIFICATION	17
8	WARNING AND ALARM CODES	18

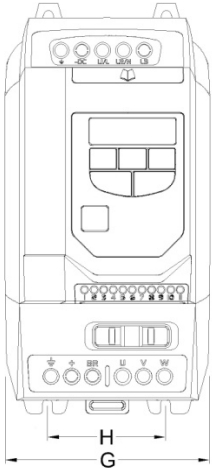
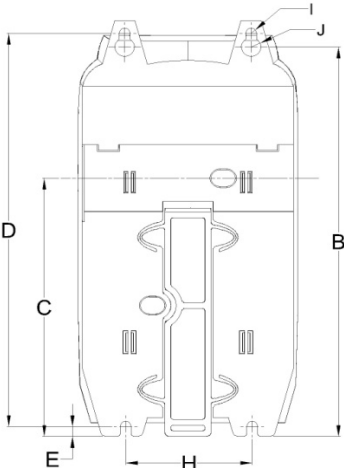
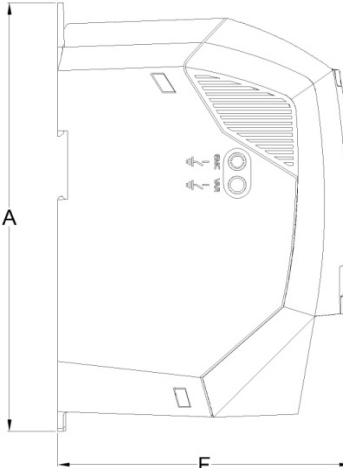
4 Installation

The drive should be mounted in a vertical position only on a flat, flame resistant vibration free mounting using the integral holes. IP66 is allowed to be mounted outdoors but it must be protected from sunlight and it also recommended having a roof to avoid snow directly on drive. See User Manual BFI-E2 for more details.

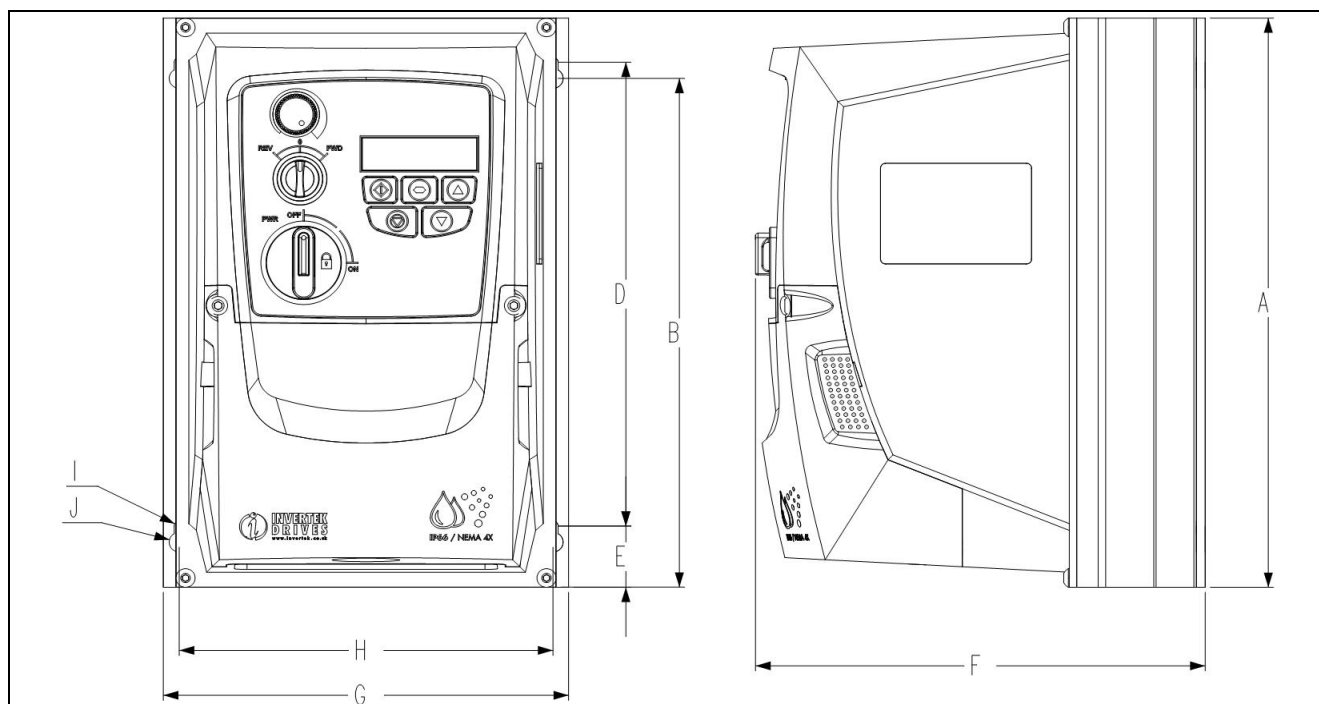


Drive IP-class and Size	X [mm] Above & Below	Y [mm] Either Side	Z [mm] Between drives	Minimum Airflow [m3/min]
IP20, size 1	75	50	0	0,31
IP20, size 2	75	50	0	0,31
IP20, size 3	100	50	0	0,74
IP66, All sizes	150	0	0	0

4.1 Physical dimensions IP20

												
Rating Drive BFI-E2- __IP20		Drive size	A Height	B	C	D	E	F Depth	G Width	H	I	J
1 x 230 V	3 x 400 V											
0023-0070 [0,37-1,5 kW]	0022-0041 [0,75-1,5 kW]	1	173	160	109	162	5	123	82	50	5.5	10
0070- 0105 [1,5-2,2 kW]	0041-0095 [1,5-4,0 kW]	2	221	207	137	209	5.3	150	109	63		
None	0140-0240 [5,5-11kW]	3	261	246	-	247	6	175	131	80		
NOTE		1 x 230 VAC BFI-E2-0070 is Size 1 without brake transistor and Size 2 with.										
		3 x 400 VAC BFI-E2-0041 is Size 1 without brake transistor and Size 2 with.										
		Control Terminal Torque Settings of 0.5 Nm. Power Terminal Torque Settings of 1 Nm										

4.2 Physical dimensions IP66



Rating Drive BFI-E2- -IP66		Drive size	A Height	B	D	E	F Depth	G Width	H	I	J
1 x 230 V	3 x 400 V										
0023-0070 [0,37-1,5 kW]	0022-0041 [0,75-1,5 kW]	1	232	207	162	25.0	179	161	149	4.0	8.0
0070- 0105 [1,5-2,2 kW]	0041-0095 [1,5-4,0 kW]	2	257	220	209	28.5	187	188	176	4.2	8.5
None	0140-0240 [5,5-11 kW]	3	310	276.5	247	33.4	229	210	197.5	4.2	8.5
NOTE		1 x 230 VAC BFI-E2-0070 is Size 1 without brake transistor and Size 2 with .									
		3 x 400 VAC BFI-E2-0041 is Size 1 without brake transistor and Size 2 with.									
		Control Terminal Torque Settings of 0.5 Nm. Power Terminal Torque Settings of 1 Nm									

IP66 drives are fitted with 3 knockout holes for cable inlet and outlet. If more than 3 cables are to enter the drive it is possible to have two or more cables going through one gland. This is to ensure IP66.

Holes and recommended glands are listed in table below. The motor cable does not have to be attached to the drive with an EMC-gland.

Cable Gland, IP66 Hole Size & recommended glands		
	Hole sizes	Gland Metric
Size 1	3 x 22mm	3 x M20
Size 2 & 3	1 x 22mm and 2 x 28 mm	1 x M20 & 2 x M25

4.3 Fuses, cable dimensions and power losses

200-240V $\pm 10\%$ - 1 Phase Input – 3 Phase Output

Output Power [kW]	BFI-E2 modell	Nominal Input Current	Fuse or MCB (type B)	Supply Cable Size, A1 40°C	Supply Cable Size, E 30°C	Nominal Output Current	Motor Cable Size, E 30°C	Max Motor Cable Length	Power losses
		Amps	Amps	mm ²	mm ²	Amps	mm ²	m	W
0.37	0023	6.7	10	1,5	1,5	2,3	1,5	25	12
0.75	0043	12.5	16	2,5	1,5	4,3	1,5	25	22,5
1.5	0015	14.8	16	2,5	2,5	7,0	1,5	25	50
1.5	0015	14.8	16	2,5	2,5	7,0	1,5	100	50
2.2	0022	22.2	25	6	2,5	10,5	1,5	100	66

380-480V $\pm 10\%$ - 3 Phase Input – 3 Phase Output

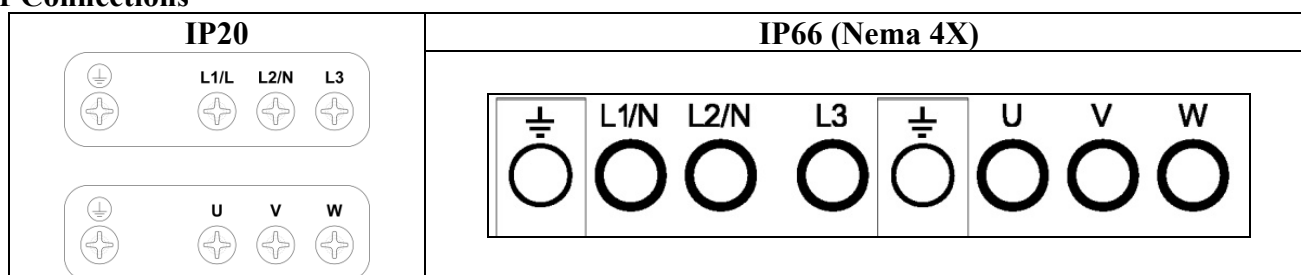
Output Power [kW]	BFI-E2 model	Nominal Input Current	Fuse or MCB (type B)	Supply Cable Size, A1 40°C	Supply Cable Size, E 30°C	Nominal Output Current	Motor Cable Size, E 30°C	Max Motor Cable Length	Power losses
		Amps	Amps	mm ²	Amps	Amps	mm ²	m	W
0.75	0022	2.9	6	1.5	1.5	2.2	1.5	25	22,5
1.5	0041	5.4	10	1.5	1.5	4.1	1.5	25	50
1.5	0041	5.4	10	1.5	1.5	4.1	1.5	50	50
2.2	0058	7.6	10	1.5	1.5	5.8	1.5	50	50
4	0095	12.4	16	2.5	1,5	9.5	1.5	50	120
5.5	0014	16.1	20	4	1,5	14	1.5	100	165
7.5	0018	20.7	25	6	2,5	18	2,5	100	225
11	0024	27.1	32	6	4	24	4	100	330

All recommended sizes of cable sizes and fuses are recommendations. Nationell laws and recommendations are to be considered.

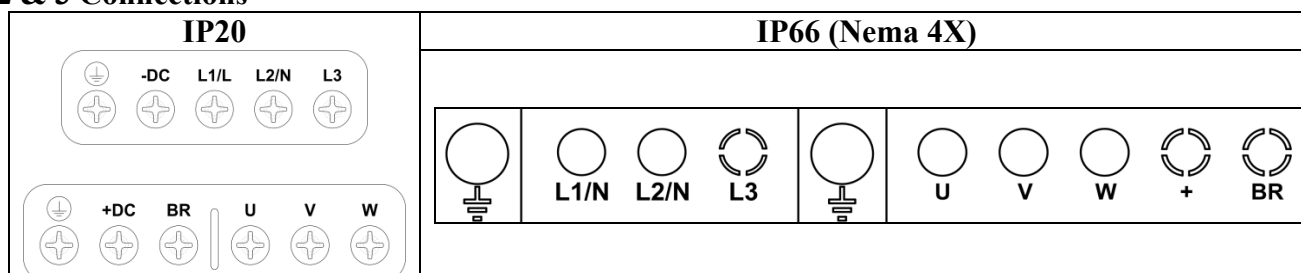
Recommended choice of cable sizes and fuses follows DIN VDE 0100 paragraph 430 Appendix, motor cable is copper, way of wiring A1 and E is following SS 424 24 24 edition. A1 means cable/conductors in some kind of duct in a maximum temperature of 40°C. E means cable/conductors mounted on a ladder. Calculated at 30°C with 9 or several cables (correctionfactor 0,78).

4.4 Overview power input/outputs

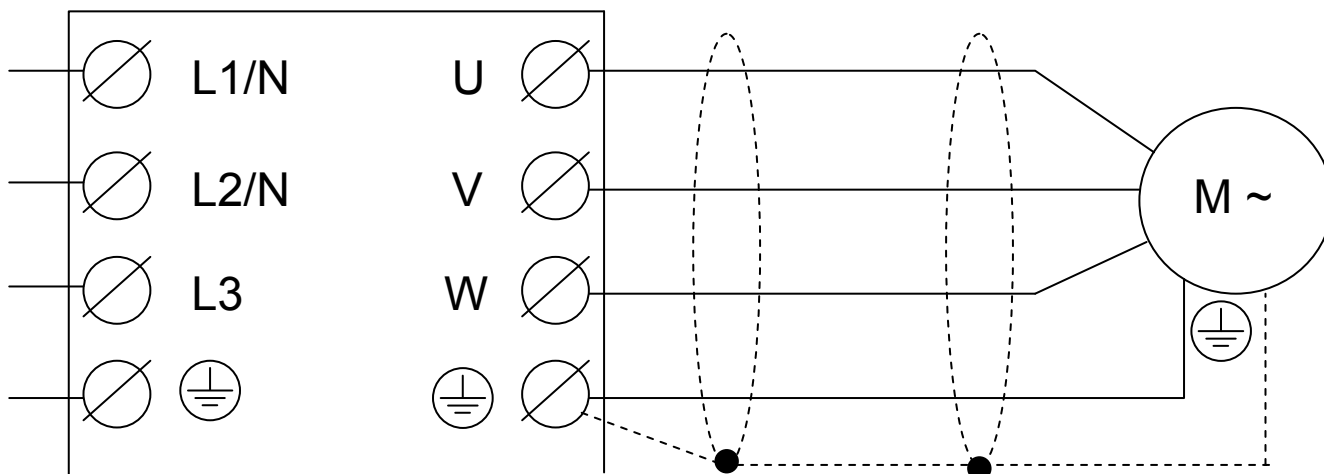
Size 1 Connections



Size 2 & 3 Connections



Installation of power supply, grounding and motor cable





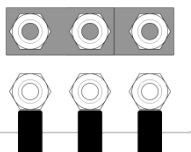
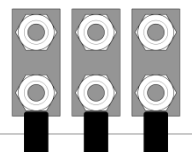
- Drive is to be connected with ground/PE by separate grounding wire.
- 1-phase power supply should be connected to L1/L, L2/N.
- 3-phase power supply should be connected to L1, L2 and L3.
- Phase sequence of power supply is not important and cable doesn't have to be a shielded.
- Protective grounding of motor is connected to drive
- Motor cable should be connected to U, V, W.

➤ Inverter Power supply 3*400 VAC:

- Rated voltage of motor 230/400, Star connection
- Rated voltage of motor 400/660, Delta connection

➤ Inverter Power supply 1*230 VAC

- Rated voltage of motor 230/400, Delta connection

	
400V	230V
690V	400V
STAR	DELTA
	
U V W	U V W

- Motor cable must be a shielded cable to fulfil EMC requirements. Example of cables to be used are RKFK, Ölflex Classic 100 CY, FKKJ-EMC, or similar.
- Shield of the motor cable should be connected to ground/earth in both ends. On motor side an EMC-gland is to be used.
- Shield of motor cable is to be connected ground terminal in the drive itself. For IP20 drives the shield can instead be clamped to the mounting plate with a clip.



- Motor must also be well attached into the mechanical frame of the machinery and has same the potential as the electrical cabinet. Separate earth connection might be necessary.
- Motor cable should avoid to be installed close to telephone-, network- or signal wiring. Minimum distance is 30 cm.

4.5 External brake resistor

For drives that have a dynamic brake transistor an optional external braking resistor is to be connected to +DC and BR when required. The brake resistor circuit should be protected by a suitable thermal protection circuit. The –DC, +DC and BR connections are blanked off by plastic tabs when sent from the factory. The plastic tabs can be removed if/when required.

Table shows models with built-in brake transistor. Resistors in table is protected by internal overload protection by putting parameter P-34=1. Either 100 ohm/200 W or 50 ohm/ 400 W can be used. The 100 ohm/200 W brake resistor is mounted inside the drive.

Drive model		Minimum Permissible resistance [ohm]	Maximum average regen. power [kW]	Brake resistor	Rated power [kW]		Resistance [ohm]
Voltage	BFI-E2				Average	Peak for 0,125 sec	
1-ph 230 VAC	0070 [1,5 kW]	47	1,5	OD-BR100-BFI	0,2	12	100
				Ext resistor	0,4	-	50
	0105 [2,2 kW]	47	2,2	OD-BR100-BFI	0,2	12	100
				Ext resistor	0,4	-	50
3-ph 400 VAC	041 [1,5 kW]	100	1,5	OD-BR100-BFI	0,2	12	100
	058 [2,2 kW]	100	2,2	OD-BR100-BFI	0,2	12	100
	095 [4,0 kW]	100	4	OD-BR100-BFI	0,2	12	100
	140 [5,5 kW]	22	5,5	OD-BR100-BFI	0,2	12	100
				Ext resistor	0,4	-	50
	180 [7,5 kW]	22	7,5	OD-BR100-BFI	0,2	12	100
				Ext resistor	0,4	-	50
	240 [11 kW]	22	11	OD-BR100-BFI	0,2	12	100
				Ext resistor	0,4	-	50

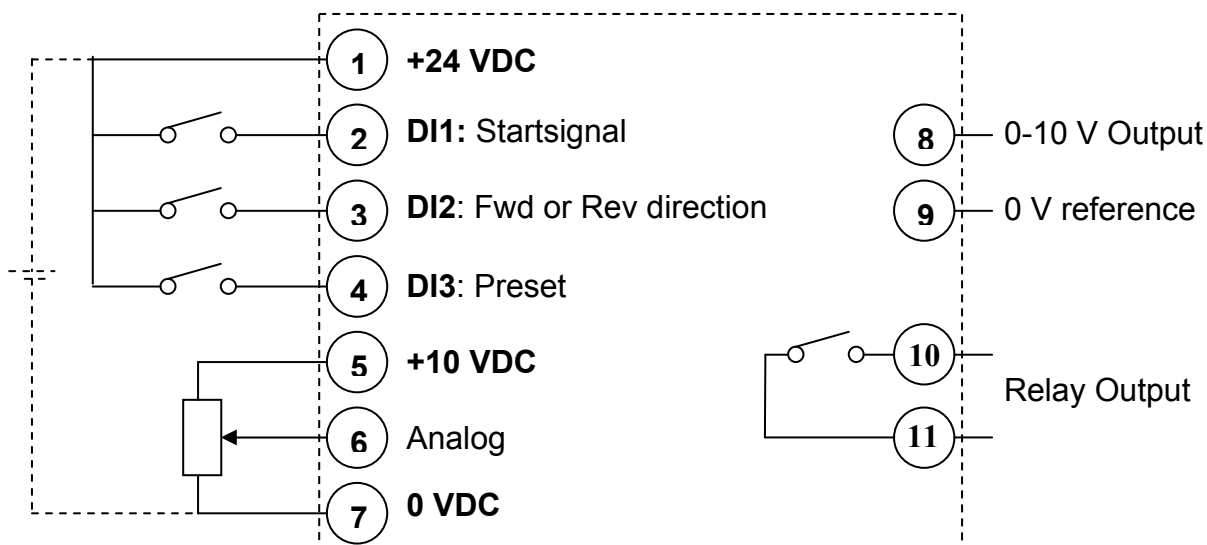
If another than standard external brake resistor is to be used an external overload protection must be used. Make sure that resistor data is within power- and resistance limits.

$$\text{Setting of external overload protection} = I = \sqrt{P/R}$$

Put also parameter P34=2.

4.6 Overview control inputs/outputs

Picture below shows an overview of control signals for the drive and factory set functionality.



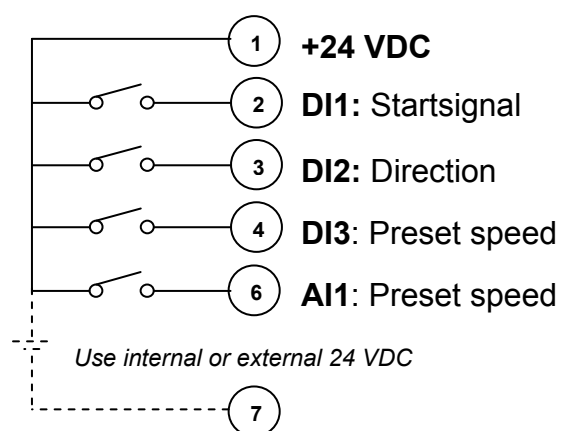
Use internal or external 24 VDC

5 Basic Parameter setting

The basic parameter setting that always is to be checked or modified is listed below:

Parameter	Name	Default setting	Recommended setting	Function
P-01	Maximum frequency	50 Hz	Max output frequency	If P-10, Motor rated speed, ≠ 0 unit will in rpm instead of Hz.
P-02	Minimum frequency	0 Hz	Min output frequency	Set to some few Hz to ensure torque in motor. If P-10, Motor rated speed, ≠ 0 unit will in rpm instead of Hz.
P-03	Acceleration time	5,0 sec		Acceleration ramptime from 0 to 50 Hz
P-04	Deceleration time	5,0 sec		Deceleration ramptime from 50 to 0 Hz
P-07	Motor rated voltage	230/400 V		Put rated voltage of motor from motor nameplate in unit V
P-08	Motor rated current	-		Put rated current of motor from motor nameplate in unit A
P-09	Motor rated frequency	50 Hz	50 Hz	Put rated frequency of motor from motor nameplate in unit Hz
P-12	Command source	0	0	0= Control by digital and/or analog signals 1=Control from Keypad
P-14	Parameter access	0	101	Normally only parameters P-01 to P-14 are accessible. All other parameters are accessible with this parameter put to 101.
P-17	Switching frequency	8 or 16 kHz		Keep as low as possible. Higher value decreases audible noise in motor but increase losses in drive.

5.1 Digital start signal in 2 directions and 4 fixed Preset speeds



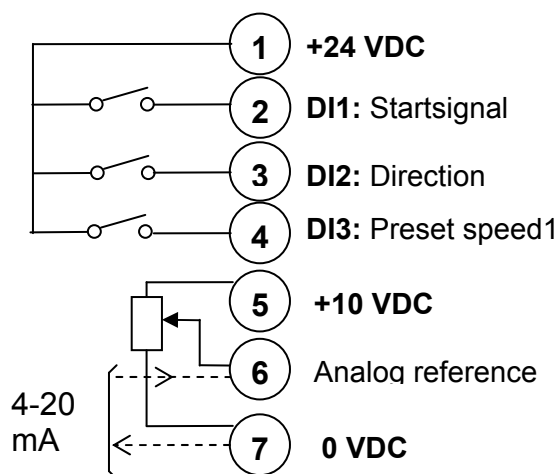
Status				Action	
DI1	DI2	DI3	AI1	P15 = 8	P15 = 9
0	0	any	any	No output from drive	
0	1	0	0	No output from drive	Reverse & PreSpeed 1
0	1	1	0	No output from drive	Reverse & PreSpeed 2
0	1	0	1	No output from drive	Reverse & PreSpeed 3
0	1	1	1	No output from drive	Reverse & PreSpeed 4
1	0	0	0	Forward & PreSpeed 1 (P-20)	
1	0	1	0	Forward & PreSpeed 2 (P-21)	
1	0	0	1	Forward & PreSpeed 3 (P-22)	
1	0	1	1	Forward & PreSpeed 4 (P-23)	
1	1	0	0	Reverse & PreSpeed 1	No output from drive
1	1	1	0	Reverse & PreSpeed 2	No output from drive
1	1	0	1	Reverse & PreSpeed 3	No output from drive
1	1	1	1	Reverse & PreSpeed 4	No output from drive

Parameter	Name	Default setting	To be set	Function
P-12	Command source	0	0	0= Control by digital and analog signals
P-15	Input selection	0		8 = Digital Startsignal / Digital Direction signal / Digital setspeed 9 = Start Forward / Start Reverse / Digital setspeed
P-20	Presetspeed1	0		Can be set between 0 to P-02 setting (Maximum speed) . If P10=0 then values are entered in Hz. If P10>0 values are entered as rpm.
P-21	Presetspeed2	0		
P-22	Presetspeed3	0		
P-23	Presetspeed4	0		

5.2 Digital start in 2 directions and analog frequency set point

Start of drive is done by either Start signal/Direction signal or Start Forward/Start Reverse. Third digital input decides whether Preset speed1, P-20 or analog input is valid.

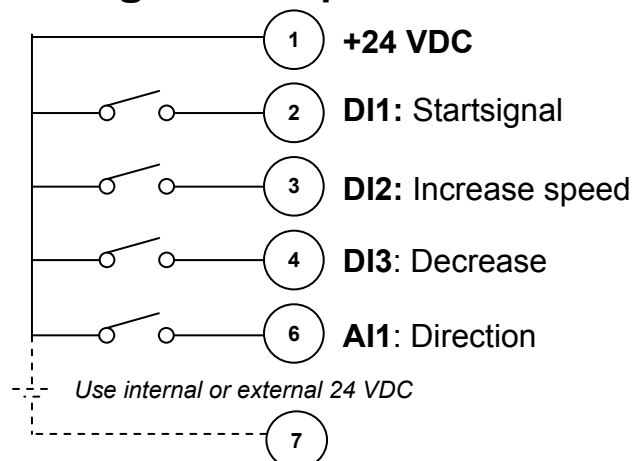
If a 4-20 mA signal is used the current should go into terminal 6 and out from terminal 7.



Status			Action	
DI1	DI2	DI3	P15 = 0	P15 = 5
0	0	any	No output from drive	
0	1	0	No output from drive	Reverse & Analog speed
0	1	1	No output from drive	Reverse & PreSpeed 1
1	0	0	Forward & Analog speed	Forward & Analog speed
1	0	1	Forward & PreSpeed 1	Forward & PreSpeed 1
1	1	0	Reverse & Analog speed	No output from drive
1	1	1	Reverse & PreSpeed1	No output from drive

Parameter	Name	Default setting	To be set	Function
P-01	Maximum frequency	50 Hz		Maximum output frequency. If P-10, Motor rated speed, ≠ 0 unit will in rpm instead of Hz.
P-12	Command source	0	0	0= Control by digital and analog signals
P-15	Input selection	0		0 = Digital Startsignal / Digital Direction signal / Analog setspeed 5 = Start Forward / Start Reverse / Analog setspeed
P-16	Analog input 1 configuration	Y0-10	Type of analog input decides	Y 0-10 = 0 to 10 VDC β-10-10 = -10 to 10 VDC. Sign decides rotation/direction A 0-20 = 0 to 20mA τ 4-20 = 4 to 20mA. Trip if signal level < 3mA ρ 4-20 = 4 to 20mA, Stop and Trip if signal level < 3mA τ 20-4 = 20 to 4mA, Trip if signal level falls < 3mA
P-20	PresetSpeed1	0		Can be set between 0 to P-02 setting (Maximum speed)
P-35	Analog input scaling	100 %		Output frequency = P1 * (P35/100) * (Analog input value/ max input of P-16) . Exampel: P-01=50 Hz, P-35=100 %, P-16= 0-10 V and Actual voltage input is 7,5 V. Output frequency = 50 x (100/100) x (7,5/10) = 37,5 Hz

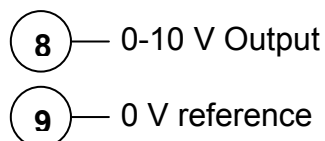
5.3 Digital motor potentiometer



Status				Action
DI1	DI2	DI3	AI1	P12=2 & P15 = 0
0	any	any	any	No output from drive
1	0	0	0	Forward & Latest speed
1	1	0	0	Forward & Increase speed
1	0	1	0	Forward & Decrease speed
1	0	0	1	Reverse & Latest speed
1	1	0	1	Reverse & Increase speed
1	0	1	1	Reverse & Decrease speed

5.4 Analog output, 0-10 VDC

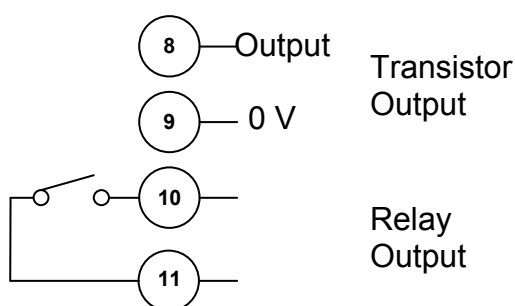
Between terminal 8 and 9 an analog output of 0-10 VDC is generated. Maximum load is 20 mA.



Parameter	Name	Default setting	Funktion
P-25	Analog output function	0	8 : Output Frequency: 0-10 => 0 to P-01 9 : Output Motor Current: 0 to 200% of P-08

5.5 Digital outputs

Terminal 8 generates 0 or 24 VDC output without any external 24 VDC power supply.



Parameter	Default setting	Function
P-18:Relay output function terminal 8 and 9	P-18=1	0: Logic 1 when Drive Enabled or running 1 : Drive Healthy. Logic 1 when power is applied to the drive and no fault exists 2 : At Target Frequency (Speed). Logic 1 when the output frequency matches the setpoint frequency 3: Logic 1 when Drive Tripped. And in a fault condition 4 : Output Frequency >= Limit. Logic 1 when the output frequency exceeds the adjustable limit set in P-19 5 : Output Current >= Limit. Logic 1 when the motor current exceeds the adjustable limit set in P-19 6 : Output Frequency < Limit. Logic 1 when the output frequency is below the adjustable limit set in P-19 7 : Output Current < Limit. Logic 1 when the motor current is below the adjustable limit set in P-19
P-25:Analog output function terminal 10 and 11	P-25=8	

5.6 Control of mechanical brake in motor

A mechanical brake is to be controlled directly from the inverter.

- If relay output on terminal 10 and 11 is used: Set P-18=4 and frequency release level in P-19. P19 is set in % of P-01, Maximum frequency.
- If transistor output on terminal 8 and 9 is used: Set P-25=4 and frequency release level in P-19. P19 is set in % of P-01, Maximum frequency.

For example if P-01=0: P19=5 % means break release at $50 \times 0,05 = 2,5 \%$.

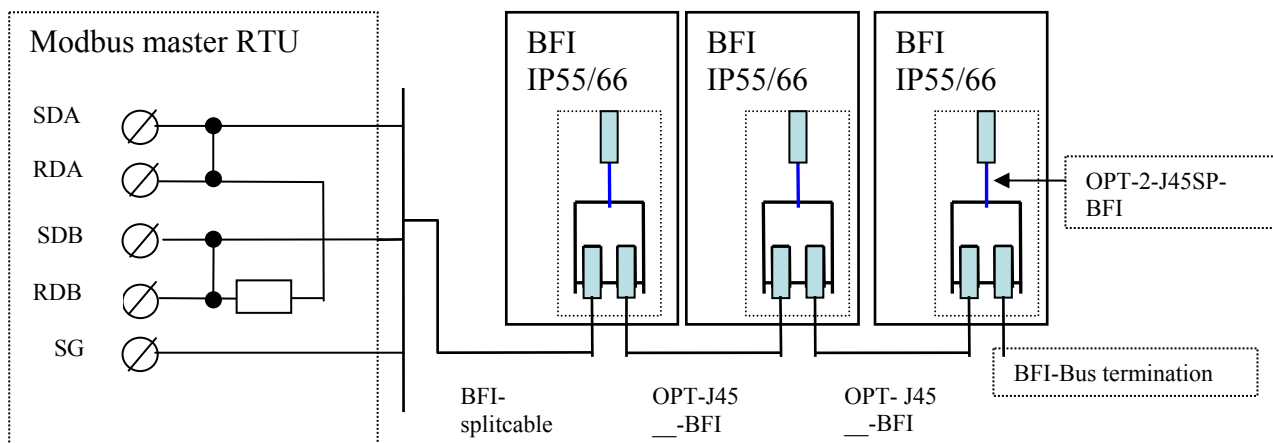
5.7 PTC-thermistor



A motor thermistor or thermistor contact is to be connected between terminals 1 and 4 as shown. P-15(value 3, 6 or 7) must be programmed for 'External Trip' on Digital Input 3. Inverter will trip with open contact or a resistance above 2.5 kOhm.

5.8 Modbus RTU and control from Mitsubishi PLC

A Modbus RTU network with BFI-E2, BFI-H2 or BFI-P2 of IP55/66 type is connected as below:

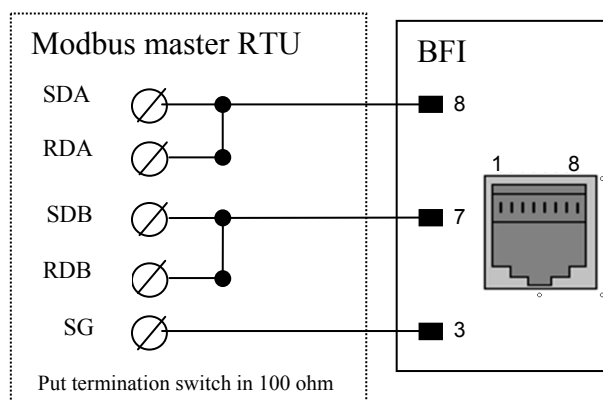
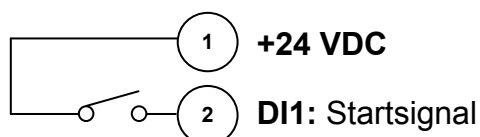


Maximum length of communication with 485-BD card in a FX-system is 50 m.

Speed setting is 19200 bit/sec, 8 data bits, 1 stop bit, No Parity.

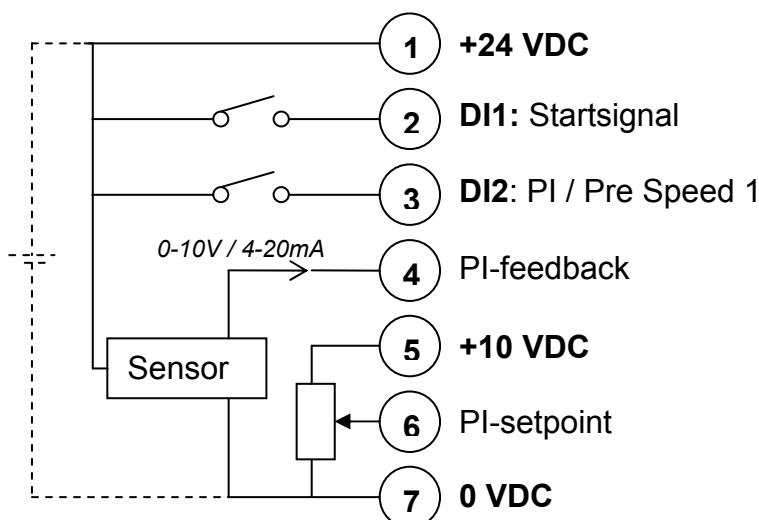
Hardware	Function	Comment
FX3G-485BD	Serial master for FX3G	Bus termination by built-in switch
FX3U-485BD	Serial master for FX3U	Bus termination by built-in switch
BFI-splitcable 2,5m	Shielded cable with one RJ45 and in the other end 3 parts marked SDA, SDB and SG.	Cable length 2,5 m.
Cable TxA BFI 3m	Shielded cable with a RJ45 and a 9-pole D-sub.	RJ45 connected in BFI and D-sub in TxA panel
OPT-J45-BFI	Shielded patchkabel with RJ45 connectors	05=0,5 m, 10=1 m, 30= 3 m
OPT-2-J45SP-BFI	Connection of 2 serial cables into one drive.	Mounted and hidden inside the IP55/66 drive
BFI-Bus termination	RJ45 with a 110 ohm resistor	To be put in the last BFI-splitter

DI1 must always be closed to start



Parameter	Name	Default setting	Recommended setting	Function
P-12	Command source	0	3	3= Control by Modbus RTU and ramptime in P-03 and P-04 4= Control by Modbus RTU and ramptime sendt by Modbus
P-14	Parameter access	0	101	101 = Parameters above P-14 accessable.
P-24	Fast Deceleration time	0		Fast Deceleration ramptime from 0 to 50 Hz
P-36	Communication setting (Power must be turned off/on when parameter has been changed)	0 96 0		3 settings in one parameter. - Stationnumber 0-63. First Drive should be stationnumber 1 - Communication speed, 192=19200 bit/sec - Communication timeout. 0 = No timeout [sec]

5.9 PI-control



Status		Action
DI1	DI2	
0	any	No output from drive
1	0	Run with PI-control
1	1	Run with Prespeed in P-20
P-44=0 : Setpoint in P-45		
P-44=1 : Analog setpoint on Terminal 6		

Parameter	Name	Default setting	Recommended setting	Function
P-12	Command source	0	5	5: PI-control with external feedback signal
P-15	Input selection	0	0	0 = PI-feedback Terminal 4. PI or Preset speed Terminal 3
P-20	Preset Speed1	0		Can be set between 0 to P-02 setting (Maximum speed)
P-41	PI Controller Proportional Gain	1,0		PI Proportional Gain. Higher values provide a greater change in the drive output frequency in response to small changes in the feedback signal. Too high a value can cause instability
P-42	PI Controller Integral Time	1,0		PI Integral Time. Larger values provide a more damped response for systems where the overall process responds slowly
P-43	PI Controller Operating Mode	0		0 : Direct Operation. Use this mode if an increase in the motor speed should result in an increase in the feedback signal 1 : Inverse Operation. Use this mode if an increase in the motor speed should result in a decrease in the feedback signal
P-44	PI Digital Setpoint	0		0 : Digital Preset PI-Setpoint in P-45 1 : Analog Input 1, Terminal 6 PI-setpoint
P-45	PI Digital Setpoint	0,0		When P-44 = 0, PI-setpoint for PI-Controller.
P-46	PI Feedback Source Select	0	0	0 : Analog Input 2 (Terminal 4) 1 : Analog Input 1 (Terminal 6) 2 : Motor Current
P-47	Analog Input 2 Format Terminal 4, PI-feedback	Y 0-10		Y 0-10 = 0 to 10 VDC A 0-20 = 0 to 20mA τ 4-20 = 4 to 20mA. Trip if signal level < 3mA

5.10 Energy Optimisation function

The Energy Optimisation function is designed to maximise the energy savings achievable when the motor and drive is not operating at its rated load. Care should be taken in using the energy optimiser function in applications where the frequency set point to the drive changes continuously, such as PI control applications. As the motor voltage is reduced, the slip of the motor may increase, resulting in a small drop in motor speed, which can make the PI control unstable. Detailed explanation of the function is to be found in *Application Notes* on www.beijer.se.

Parameter	Name	Default setting	Function
P-06	Energy Optimisation	0	0 = Disbaled 1 = Enabled

5.11 Spin start

Available in drives size 2 and 3. On start the drive will attempt to determine motor speed and control the motor from its current speed.

In size 1 drives a DC-current is injected in the motor to ensure it is stopped.

Parameter	Name	Default setting	Function
P-33	Spin Start	0	0 = Disbaled 1 = Enabled

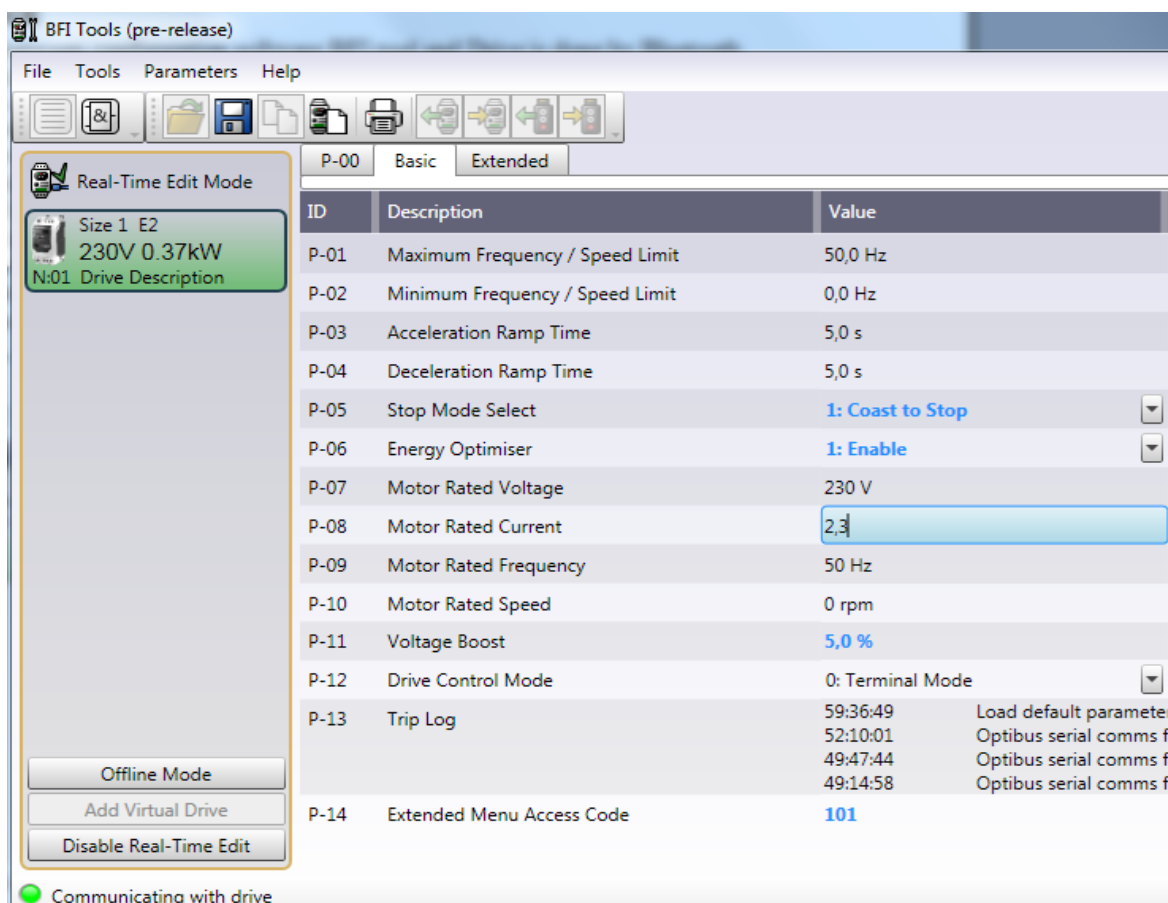
5.12 Optistick

Communication between configuration software BFI-tool and drive is done by Bluetooth through Optistick. Optistick is just plugged into the RJ45 connector of the drive.

Configuration of Optistick in the PC is done in *Bluetooth device*. You need to enter a pairing code which is 0000.

Each physical Optistick is an individual and needs to be configured individually.






After configuration please note what com port your Optistick was given. This must then be set in BFI-tools *Tools/Select COM Port*

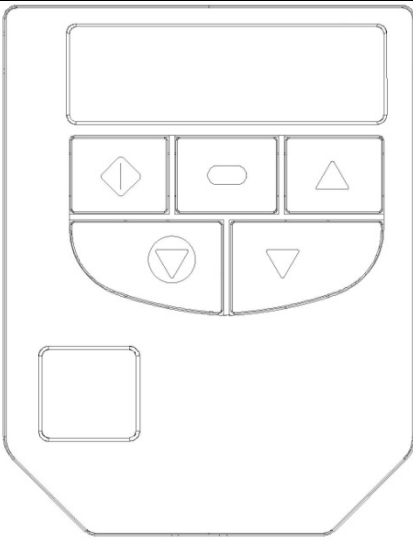


P-14 must be set to 101 to access all parameters in the drive.







6 Keypad

The drive is configured and its operation monitored via the keypad and display.

















	NAVIGATE	Used to display real-time information, to access and exit parameter edit mode and to store parameter changes
	UP	Used to increase speed in real-time mode or to increase parameter values in parameter edit mode
	DOWN	Used to decrease speed in real-time mode or to decrease parameter values in parameter edit mode
	RESET / STOP	Used to reset a tripped drive. When in keypad mode is used to Stop a running drive.
	START	When in keypad mode, used to Start a stopped drive or to reverse the direction of rotation if bi-directional keypad mode is enabled



6.1 Changing parameters

1. Hold the  key for >1s whilst the drive displays Stop
2. The display changes to P-01, indicating parameter 01.
3. Press and release the  key to display the value of this parameter.
4. Change to the required value using the  and  keys.
5. Press and release the  key once more to store the change.
6. Press and hold the  key for >1s to return to real-time mode.
7. The display shows Stop if drive is stopped or the real-time information if the drive is running.

6.2 Run motor from keypad

- Set parameter P-12=1
- Enable drive by closing the switch between control terminals 1 & 2. Display will show Stop.
- Press the  key. The display shows H 0.0.
- Press  to increase speed.
- The drive will run forward, increasing speed until  is released.
-  The rate of acceleration is controlled by the setting of P-03, check this before starting.
- Press  to decrease speed. The drive will decrease speed until  is released. The rate of deceleration is limited by the setting in P-04
- Press the  key. The drive will decelerate to rest at the rate set in P-04.
- The display will finally show STop at which point the drive is disabled
- To preset a target speed prior to enable, press the  key whilst the drive is stopped. The display will show the target speed, use the  &  keys to adjust as required then press the  key.
- Pressing the  key will start the drive accelerating to the target speed.
- To allow the drive to be controlled from keypad in a forward and reverse direction, set P-12 =2:
- Press the  key. The display changes to H 0.0.
- Press  to increase speed
- The drive will run forward, increasing speed until  is released.
- To reverse the direction of rotation of the motor, press the  key again.

6.3 Factorysetting of Drive

- Turn of Start signals and remove Enable signal on terminal 2.

Press Δ , ∇ and \blacktriangledown for >2s. The display shows P-dEF. Press the \blacktriangledown button to acknowledge and reset the drive.

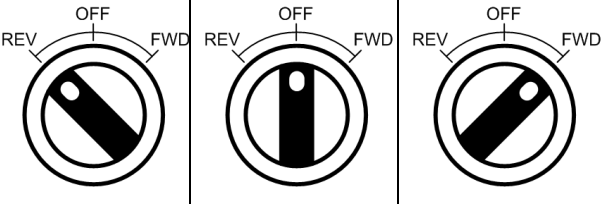
6.4 Monitoring from Keypad

- Press the \diamond key. The display indicates either Output Current by *A digit.digit* or Output Frequency by *H digit.digit*.
- More variables to monitor are available if P14=101. Then parameter group P00 is available and following vales can be monitored:

	Description	Display range	Explanation
P00-01	1st Analog input value	0 ... 100%	100% = max input voltage
P00-02	2nd Analog input value	0 ... 100%	100% = max input voltage
P00-03	Speed reference input	-P-01 ... P-01	Displayed in Hz if P-10 = 0, otherwise displayed in RPM
P00-04	Digital input status	Binary value	Drive digital input status
P00-05	Reserved	0	Reserved
P00-06	Reserved	0	Reserved
P00-07	Applied motor voltage	0 ... 600V AC	Value of RMS voltage applied to motor
P00-08	DC bus voltage	0 ... 1000V dc	Internal DC bus voltage
P00-09	Internal temperature	-20 ... 100 °C	Temperature of heatsink in °C
P00-10	Hours run meter	0 to 99 999 hours	Not affected by resetting factory default parameters
P00-11	Run time since last trip (1)	0 to 99 999 hours	Run-time clock stopped by drive disable or trip.
P00-12	Run time since last trip (2)	0 to 99 999 hours	Run-time clock stopped by drive disable or trip. Not reseted by power down / power up cycling.
P00-13	Run time since last disable	0 to 99 999 hours	Run-time clock from zero and stopped on drive disable
P00-14	Drive Effective Switching Frequency	4 to 32 kHz	Actual drive effective output switching frequency. Value may be lower than P-17 if the drive is too hot
P00-15	DC bus voltage log	0 ... 1000V	8 most recent values prior to trip, updated every 250ms
P00-16	Thermistor temperature log	-20 ... 120 °C	8 most recent values prior to trip, updated every 500ms
P00-17	Motor current	0 to 2x rated current	8 most recent values prior to trip, updated every 250ms
P00-18	Software ID, IO & motor ctrl	e.g. "1.00", "47AE"	Version number and checksum. "1" on LH side indicates I/O processor, "2" indicates motor control
P00-19	Drive serial number	000000 ... 999999	Unique drive serial number, 540102 / 32 / 005
P00-20	Drive identifier	Drive rating	Drive rating, drive type, e.g. 0.37, 1 230,3P-out

6.5 IP66, Mainswitch, start/stop switch and potentiometer

By adjusting the parameter settings the drive can be configured for multiple applications and not just for Forward or Reverse. This could typically be for Hand/Off/Auto applications (also known and Local/Remote) for HVAC and pumping industries.

			Parameters to Set		Notes
Switch Position			P-12	P-15	
Run Reverse	STOP	Run Forward	0	0	Factory Default Configuration Run Forward or Reverse with speed controlled from the Local POT
STOP	STOP	Run Forward	0	5, 7	Run forward with speed controlled from the local POT. Run Reverse - disabled
Preset Speed 1	STOP	Run Forward	0	1	Run Forward with speed controlled from the Local POT. Preset Speed 1 provides a 'Jog' Speed in P-20
Run Reverse	STOP	Run Forward	0	6, 8	Run Forward or Reverse with speed controlled from the Local POT
Run in Auto	STOP	Run in Hand	0	4	Run in Hand – Speed controlled from the Local POT Run in Auto 0 Speed controlled using Analog input 2 e.g. from PLC with 4-20mA signal.
Run in Speed Control	STOP	Run in PI Control	5	1	In Speed Control the speed is controlled from the Local POT In PI Control, Local POT controls PI set point
Run in Preset Speed Control	STOP	Run in PI Control	5	0, 2, 4, 5, 8..12	In Preset Speed Control, P-20 sets the Preset Speed In PI Control, POT control the PI set point P-44=1
Run in Hand	STOP	Run in Auto	3	6	Hand – speed controlled from the Local POT Auto – Speed Reference from Modbus
Run in Hand	STOP	Run in Auto	3	3	Hand – Speed reference from Preset Speed 1 (P-20) Auto – Speed Reference from Modbus

7 Specification

	BFI-E2 (1 x 230 V)						BFI-E2 (3 x 400 V)						
Drive Model	023	043	070	105		022	041	058	095	140	180	240	
Output power, kW	0,37	0,75	1,5	2,2		0,75	1,5	2,2	4,0	5,5	7,5	11	
Rated output current A,	2,3	4,3	7,0	10,5		2,2	4,1	5,8	9,5	14,0	18,0	24,0	
Tillåten överström	175 % of rated current for 2,0 s; 150 % for 1 min												
Output voltage	3-fas, 0 V to Supply voltage												
Output frequency	0 – 500 Hz												
Input voltage	1-phase, 200 – 240 VAC						3-phase, 380-480 VAC						
Voltage fluctuations	180 – 264 VAC						342 – 528 VAC						
Input frequency	48-62 Hz												
Nominal input current A	6,7	12,5	14,8	22,2		2,9	5,4	7,6	12,4	16,1	20,7	27,1	
Internal Braketransistor	No		Option	Built in		No	Option	Built in					
Control methods	Linear U/f-reglering, Adjustable linear, Energy Optimised												
Start methods	Digital, Push button Fwd/Rev/Stop, Keypad, Modbus RTU												
Frequency setpoint	Digital Preset speed, Digital motorpotentiometer, analogt 4 – 20 mA, 0 –10 V, Keypad, Modbus RTU												
Digital input	2 x Programmable Digital Input and 2 x User-selectable Digital or Analog Inputs,												
Analog input	2 x User-selectable Digital or Analog Inputs. 4-20 mA or 0-10 V or -10 to 10. 12 bit												
Transistor output	1 x User-selectable Digital or Analog Output. Maximum current 20 mA.												
Relay output	1 x Progammable Relay (single pole), Maximum load 6,0 A with 230 V or 5A with 30 VDC.												
Analog output	1 x User-selectable Digital or Analog Output, 0-10 V DC. Maximum current 20 mA. 10 bit.												
Communication	Modbus RTU												
Acc/Deceration time	0 to 600 sec, 2:nd deceleration ramp												
Stop mode	Ramping / Fast stop / Coasting / DC-brake												
Functions	PI-control, Spin start, Automatic restart, Skip frequency, Stop method at Voltage interruption, Eneyr Optimiser, Parameter access lock,												
Protection class	IP20 or IP66												
Ambient temperature	IP20: -10 °C to +50 °C, IP66: -10 °C to +40 °C, Storage temperature is -40 °C to +60 °C												
Maximum humidity	Max. 95 % non-condensing												
Environment	No airborne dust, corrosive gases or liquids, conductive contaminants (such as condensation, carbon dust, and metallic particles), high moisture, salt or chemical content environments												
Maximum altitude	2000 meter bove sea level, Derate above 1000 m: 1 %/100m												
Vibrations	IEC 60068-2-29, IEC 60068-2-64, IEC 60068-2-6												
Safety functions	No safety inputs												
EMC	Built-in EMC-filter, - EN61800-3:2004, 1*230 VAC: Class C1, C2, C3 and C4 - EN61800-3:2004, 3*400 VAC: Class C2, C3 and C4												
Approvals	CE, cUL, UL, RoHS, Carbon Trust, C Tick, SGS, GOST												
Maximum motorcable legth, m	25	25	25/100	100		25	25/50	50	50	100	100	100	
Cooling fans IP66	No	Internal Stirrer fan				Internal Stirrer fan							
Cooling fans IP20	No	Heatsink fan				Heatsink fan							
Frame size	1	1	1 or 2	2		1	1 or 2	2	2	3	3	3	
Weight	0.5	0.6	0.9	1.1		1.5	1.9	1.2	1.2	1.3	1.4	1.5	

8 Warning and Alarm codes

Drive Display Fault Code	Fault Number	Description	Corrective Action
StoP	0x00	Drive is healthy and in a stopped condition. The motor is not energised. No enable signal is present to start drive	
P - dEF	0X0A	Factory Default parameters have been loaded	Press the STOP key, drive is ready to configure for particular application
0 - 1	0x03	Instantaneous Over current on the drive output. Excess load or shock load on the motor.	<p>Fault occurs immediately on drive enable or run command Check the output wiring connections to the motor and the motor for short circuits phase to phase and phase to earth.</p> <p>Fault occurs during motor starting then check</p> <ul style="list-style-type: none"> motor is free to rotate and there are no mechanical blockages. if the motor has a brake fitted, check the brake is releasing correctly. star-delta connection of motor wiring Increase the acceleration time in P-03. Reduce the motor boost voltage in P-11 <p>Fault occurs when motor operating at constant speed Investigate overload or malfunction.</p> <p>Fault occurs during motor acceleration or deceleration The accel/decel times are too short. Increase P-03 or P-04.</p>
I.t - trP	0x04	Motor thermal overload protection trip. The drive has tripped after delivering >100% of value in P-08 for a period of time to prevent damage to the motor.	<ul style="list-style-type: none"> Ensure the correct motor nameplate current value is entered in P-08. Check for correct Star or Delta wiring. Check to see when the decimal points are flashing (which indicates the output current > P-08 value). Increase acceleration ramp (P-03) or decrease motor load. Check the total motor cable length is within the drive specification. Check the load mechanically to ensure that no jams, blockages or other mechanical faults exist
QI - b	0x01	Brake channel over current (excessive current in the brake resistor)	Check the cabling to the brake resistor and the brake resistor for short circuits or damage. Ensure the resistance of the brake resistor is equal to or greater than the minimum value for the relevant drive.
OL - br	0x02	Brake resistor thermal overload. The drive has tripped to prevent damage to the brake resistor	<p>Only occurs if P-34 = 1. The internal software protection for the brake resistor has activated to prevent damage to the brake resistor.</p> <p>If a standard braking resistor is being used, P-34 MUST be 1 Increase deceleration time (P-04) or 2nd dec. time (P-24). Reduce the load inertia</p> <p>For Other Brake Resistors Ensure the resistance of the brake resistor is equal to or greater than the minimum value for the relevant drive. Use an external thermal protection device for the brake resistor. In this case, P-34 may be set to 2</p>
PS - trp	0x05	Hardware Over Current	<ul style="list-style-type: none"> Check the wiring to motor and for phase to phase and phase to earth short circuits. Disconnect motor and cable. Retest. If the drive trips with no motor connected, replace drive. Check complete installation, test for insulation failure.
O - Uolt	0x06	Over voltage on DC bus	Check the supply voltage is within the allowed tolerance for the drive. If the fault occurs on deceleration or stopping, increase the deceleration time in P-04 or install a suitable brake resistor and activate the dynamic braking function with P-34
U - Uolt	0x07	Under voltage on DC bus	The incoming supply voltage is too low. This trip occurs routinely when power is removed from the drive. If it occurs during running, check the incoming power supply voltage and all components in the power feed line to the drive.
O - t	0x08	Heatsink over temperature	The drive is too hot. Check the ambient temperature around the drive is within the drive specification. Ensure sufficient cooling air is free to circulate around the drive. Increase the panel ventilation if required. Ensure sufficient cooling air can enter the drive, and that the bottom entry and top exit vents are not blocked or obstructed.
U - t	0x09	Under temperature	Trip occurs when ambient temperature is less than -10°C. Temperature must be raised over -10°C in order to start the drive.
th - Flt	0x10	Faulty thermistor heatsink.	Refer to your IDL Authorised Distributor.
E - triP	0x0B	External trip (on digital Input 3)	E-trip requested on digital input 3. Normally closed contact has opened for some reason. If motor thermistor is connected check if the motor is too hot.
SC - trP	0x0C	Comms loss trip	Check communication link between drive and external devices. Make sure each drive in the network has its unique address.
P - LOSS	0x0E	Input phase loss trip	Drive intended for use with a 3 phase supply has lost one input phase.
SPI n - F	0x0F	Spin start failed	Spin start function failed to detect the motor speed.
dAtA - F	0x11	Internal memory fault.	Parameters not saved, defaults reloaded. Try again.
4 - 20 F	0x12	Analog input current out of range	Check input current in range defined by P-16.
SC - FLt	-	Internal drive Fault	Refer to your IDL Authorised Distributor.
FAULty	-	Internal drive Fault	Refer to your IDL Authorised Distributor.